A review of terrestrial wildlife trade originating from Solomon Islands

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ABSTRACT

The wildlife export trade from Solomon Islands is growing rapidly. At least 19 species of reptile and four species of frog have been exported. A total of 14 137 and 13 538 reptiles and amphibians were exported in 1989 and 1990 respectively. The most commonly and consistently exported herpetofauna are *Corucia zebrata, Candoia carinata, Varanus indicus* and *Ceratobatrachus guentheri.* Butterflies and other insects constitute another major group exported. The total number of butterflies known to have been exported from Solomon Islands was 5 669 and 5 032 during 1989 and 1990 respectively. Continued uncontrolled exploitation of Solomon Islands fauna is likely to result in local extinctions of species in heavily collected areas, and poses a threat to rare or restricted species. It is therefore urgent that the Solomon Islands Government implement wildlife management recommendations which includes legislation, regulations, and careful monitoring of trade.

INTRODUCTION

This review is part of a broader study and assessment of the wildlife management needs of Solomon Islands (Leary 1990a). Little is known of Solomon Islands' fauna. A bibliography of its terrestrial vertebrates (Leary 1990b), reveals only 331 references. Most were largely confined to taxonomy and distribution. Yet, even the taxonomy of many genera is unclear and is in need of revision, and knowledge of the distribution of most species can only be described at best as patchy.

In Solomon Islands, rights to fauna are not vested in the Crown, but with the landowner, and the ethos of conserving fauna for aesthetic or any other purpose is uncommon. Many species of wildlife have traditionally been utilized for food, medicines and artifacts. This continues today, and since 1987, commercial utilization of wildlife for export has also occurred.

The only legislation covering terrestrial animals is an antiquated Wild Birds Protection Act in 1914. It prohibits the taking, holding, sale and export of a number of bird species. Solomon Islands has no comprehensive fauna protection legislation. This lack of legislation and effective regulation of trade, coupled with the limited available information on the ecology and status of species, has resulted in increased concern at the threat to wild populations of unregulated trade. This prompted the Solomon Islands Government to request, through the South Pacific Regional Environment Programme (SPREP), a review of wildlife trade.

There have been no previous reviews of wildlife trade, and prior to the commencement of this project, no trade statistics were collected. A more detailed analysis of wildlife trade and the recommendations arising from that review may be found in Leary (1990a). It examines the trade and its management and makes detailed recommendations on: species which should be prohibited from trade; species for which trade should be permitted; record keeping and licensing procedures; administration of trade; conditions for caging, holding and shipping fauna; and monitoring of trade and the effects of trade on wild populations. In addition, it provides guidelines for drafting legislation to regulate the trade. It also makes an assessment of wildlife management issues and needs other than those dealing specifically with trade. In conjunction with that review, Leary (1990c) provides a review of the state of knowledge on the ecology of trade species and compiles the first systematic checklist of all known Solomon Islands terrestrial vertebrate fauna. The current paper summarizes export statistics from Leary (1990a) for the period January to December 1989 and includes additional trade statistics from January to December 1990.

The Fauna

The ecology of only a few species is moderately well known (McCoy 1980; Phillips 1968; Brown 1952; Mayr 1978). Only 62 of the 331 references on terrestrial vertebrates (Leary 1990b) contained any notes or comments on the ecology of species. Most of these were only brief comments or anecdotal information on such things as diet, clutch size, gestation period, or parasites. For many species the basic information on distribution, status, reproduction and habitat preference is unknown.

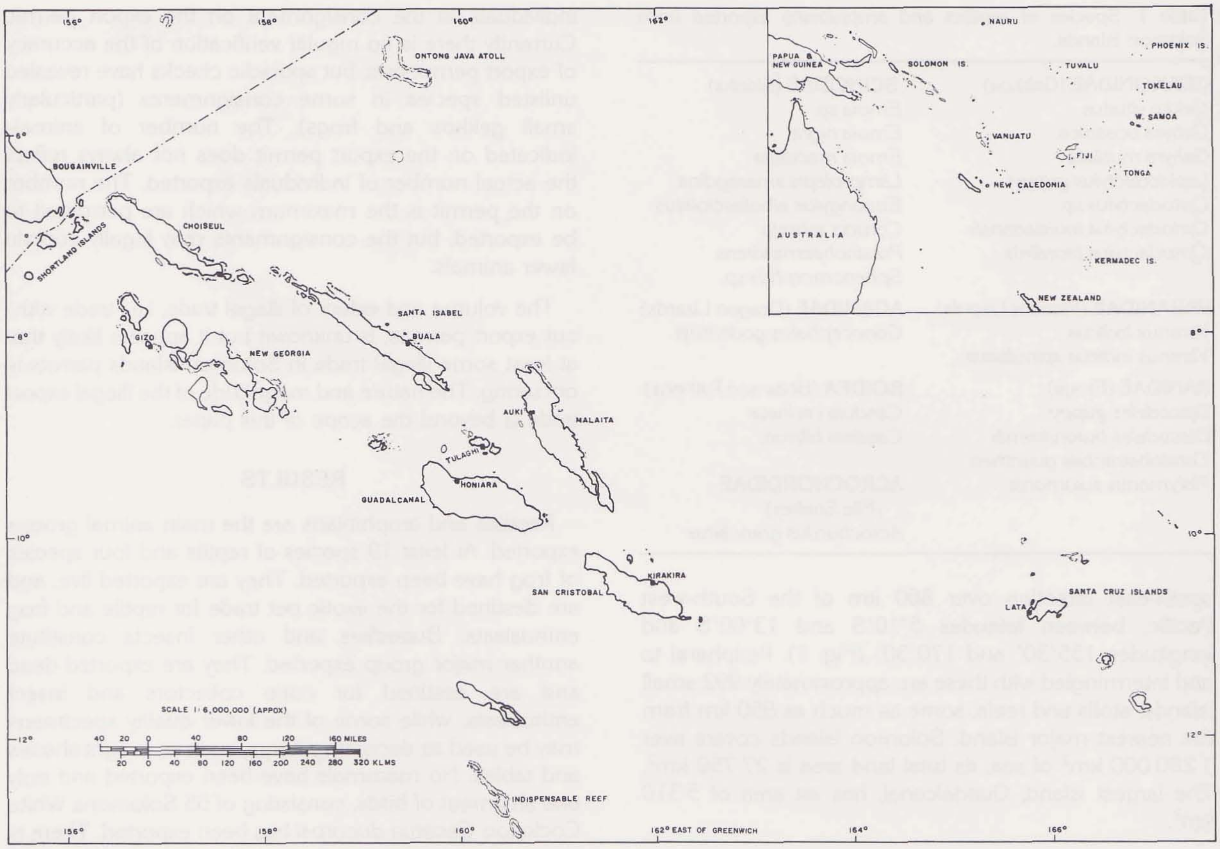


Figure 1. Location of the Solomon Islands.

However, what is known of Solomon Islands fauna suggests that it is of international importance. The level of endemism is relatively high in comparison with other Pacific island nations (with the exception of New Caledonia). At the species level, 44% of land birds that breed in Solomon Islands are endemic, while at the subspecies level a further 38% are also endemic (Diamond 1976). Diamond (1976) suggests that not even in the Galapagos Islands is the phenomenon of speciation and population variation between islands so obvious.

The percentage of endemic species and subspecies of the herpetofauna is also relatively high — approximately 30% of 77 species of reptile (McCoy 1980), and approximately 38% of 18 species of amphibians (Brown 1952). The taxonomy and level of endemism in the 51 species of native mammal is unclear (Leary 1990c), with the taxonomy of several genera under revision. However, it appears that at least 26 species or over 50% may be endemic (Flannery, pers. comm.). The most recent comprehensive work on the systematics of flying foxes, megachiroptera (Phillips 1968), lists nine species and 19 subspecies of the 16 species as endemics, and this is likely to increase with further taxonomic revisions (Flannery, pers. comm.). Of the other mammals, it appears that at least six (possibly seven), species of giant rodents of the genera *Uromys* and *Solomys* and at least one genus (*Anthops*) and one other species of small insectivorous bat, microchiroptera, are endemic to the Solomon Islands geographic area, which includes Bougainville. This makes Solomon Islands mammal fauna one of the most diverse and endemic to be found on oceanic islands anywhere on earth (Flannery, pers. comm.).

The diversity of birds, the best studied group, is high when compared with other Pacific island nations: 172 species of land birds in Solomon Islands compared with 60 species in Vanuatu, 68 in New Caledonia, 67 in Fiji and Tonga combined, 57 in Micronesia, and 35 in Western and American Samoa combined (Mayr 1978).

Location

The nation of Solomon Islands consists of a double chain of six major islands, extending in a north-west,

Table 1. Species of reptiles and amphibians exported from Solomon Islands.

GEKKONIDAE (Gekkos)
Gekko vittatus
Gehyra oceanica
Gehyra mutilata
Lepidodactylus guppyi
Cyrtodactylus sp.
Cyrtodactylus louisiadensis
Cyrtodactylus biordinis

SCINCIDAE (Skinks)
Emoia sp.
Emoia nigra
Emoia maculata
Lamprolepis smaragdina
Eugongylus albofasciolatus
Corucia zebrata
Prasinohaema virens
Sphenomorphus sp.

VARANIDAE (Monitor Lizards)
Varanus indicus
Varanus indicus spinulosus

AGAMIDAE (Dragon Lizards)
Gonocephalus godeffroyi

RANIDAE (Frogs)
Discodeles guppyi
Discodeles bufoniformis
Ceratobatrachus guentheri
Platymantis solomonis

BOIDEA (Boas and Pythons)
Candoia carinata
Candoia bibroni

ACROCHORDIDAE
(File Snakes)
Acrochordus granulatus

south-east direction over 860 km of the South-west Pacific, between latitudes 5°10′S and 13°00′S and longitudes 155°30′ and 170°30′ (Fig. 1). Peripheral to and intermingled with these are approximately 992 small islands, atolls and reefs, some as much as 850 km from the nearest major island. Solomon Islands covers over 1 280 000 km^2 of sea, its total land area is 27 750 km^2. The largest island, Guadalcanal, has an area of 5 310 km^2.

Continuing the island chain to the north-west is the island of Bougainville, politically a part of PNG, and offset to the south-west is the Vanuatu island chain. The Australian mainland lies 1 600 km to the south-west.

METHODS

In 1987 the Solomon Island Government announced that an export trade in Solomon Islands fauna was to be permitted, but until the commencement of this study no regular export statistics were collected.

The reptile, amphibian and insect trade is administered under policy guidelines (not legislation), by the Environment and Conservation Division, Ministry of Natural Resources. Only one exporter of reptiles is licensed per province (of which there are seven), and in some cases another person is licensed to export insects. Each export consignment requires a "General Export Permit for Wildlife". This is also issued by the Environment and Conservation Division. These export permits are the only wildlife statistics collected and form the basis of this review.

These statistics rely upon the honesty of exporters to properly declare and identify species and number of individuals in the consignment on the export permit. Currently there is no regular verification of the accuracy of export permit lists, but sporadic checks have revealed unlisted species in some consignments (particularly small gekkos and frogs). The number of animals indicated on the export permit does not always reflect the actual number of individuals exported. The number on the permit is the maximum which are permitted to be exported, but the consignments may legally contain fewer animals.

The volume and extent of illegal trade, i.e., trade without export permits, is unknown but it appears likely that at least some illegal trade in Solomon Islands parrots is occurring. The nature and magnitude of the illegal export trade is beyond the scope of this paper.

RESULTS

Reptiles and amphibians are the main animal groups exported. At least 19 species of reptile and four species of frog have been exported. They are exported live, and are destined for the exotic pet trade for reptile and frog enthusiasts. Butterflies and other insects constitute another major group exported. They are exported dead and are destined for curio collectors and insect enthusiasts, while some of the lower quality specimens may be used as decorative items, such as in light shades and tables. No mammals have been exported and only one shipment of birds, consisting of 55 Solomons White Cockatoo *Cacatua ducorpsi* has been exported. There is also a large export trade in saltwater crocodile skins *Crocodylus porosus* and hawksbill turtle shell *Eretmochelys imbricata* (Leary 1990a), which is beyond the scope of this paper.

The wildlife export trade from Solomon Islands is growing rapidly. Although comprehensive records prior to 1989 do not exist, information gained from incomplete quarantine and veterinary records indicates that only five or six reptile species were exported and that the number of individuals was probably less than 500 between 1987 and mid-1988 (Leary 1990a). The increase in volume and diversity began in mid-1988 (as indicated by export permits issued for 1 923 animals from August to December 1988), and continued to rise in 1989.

Reptiles and Amphibians

The species of reptiles and amphibians known to have been exported from Solomon Islands are listed in Table 1. At least 19 of the 77 reptile species, and four of the 18 amphibian species have been exported. The total number of individuals exported by species, genus or family as recorded on permits during 1989 and 1990 is shown in Table 2.

A total of 14 137 and 13 538 reptiles and amphibians were exported in 1989 and 1990 respectively. *Corucia zebrata* (the prehensile tailed skink, or "unu") is the most commonly and consistently exported species. *Candoia carinata* (pacific ground boa, or "sleeping snake"), *Varanus indicus* (mangrove monitor, or "iguana") *Ceratobatrachus guentheri* (horned frog), and *Gekko vittatus* (striped gekko) are also consistently exported. These were exported in large numbers almost every month.

Table 2. Number of reptiles and amphibians exported from Solomon Islands.

	Jan.–Dec. 1989	Jan.–Dec. 1990
Corucia zebrata	4 104	3 365
Candoia carinata	2 520	1 731
Candoia bibroni	491	845
Candoia sp.	—	20
Varanus indicus	1 592	1 979
Ranidae*	1 308	435
Ceratobatrachus guentheri	1 832	1 480
Platymantis solomonis	—	50
Discodeles guppyi	9	61
Discodeles sp.	—	15
Gekko vittatus	1 015	780
Gekkonidae**	857	413
Cyrtodactylus sp.	20	206
Cyrtodactylus biordinis	—	430
Cyrtodactylus louisiadensis	—	352
Emoia sp***	180	335
Emoia maculata	—	110
Emoia nigra	—	275
Sphenomorphus sp.	—	20
Lamprolepis smaragdina	108	270
Eugongylus albofasciolatus	71	281
Gonocephalus godeffroyi	23	40
Acrochordus granulatus	7	45
TOTAL	14 137	13 538

Notes: *Record keeping was not always accurate. Ranidae includes some *D. guppyi* and *C. guentheri* and may include some other species listed in Table 1.

**Gekkonidae includes some *G. vittatus* and *Cyrtodactylus* sp. and may include some other gekko species listed in Table 1.

****Emoia* sp. may include some *Emoia nigra* and *E. maculata.*

During 1989, 93% of all animals were imported by the USA, 5% by West Germany, 1% by Japan and 1% by Belgium. During 1990 63% of all animals were imported by the USA, 13% by the United Kingdom, 11% by Malaysia, 7.5% by Belgium, 4% by West Germany, 1% by Japan, and 0.5% by Netherlands. The lower percentage of animals imported by the USA in 1990 was largely due to problems with freight connections with the USA in the latter part of 1990. This has now been rectified and it is likely that percentage imported by the USA in 1991 will rise.

Butterflies and Other Insects

All insects are wild caught or pupae collected from the wild and hatched by the exporter. *Ornithoptera* (birdwing butterflies) are the most important component of the insect trade as they receive the highest prices. In order of descending value, and hence importance as an export, they can be ranked as follows: *Ornithoptera* (birdwing butterflies); other Papilionidae butterflies (i.e., *Graphium* and *Papilio*); non-Papilionidae butterflies (e.g., common butterflies); and other non-butterfly insects (e.g., beetles).

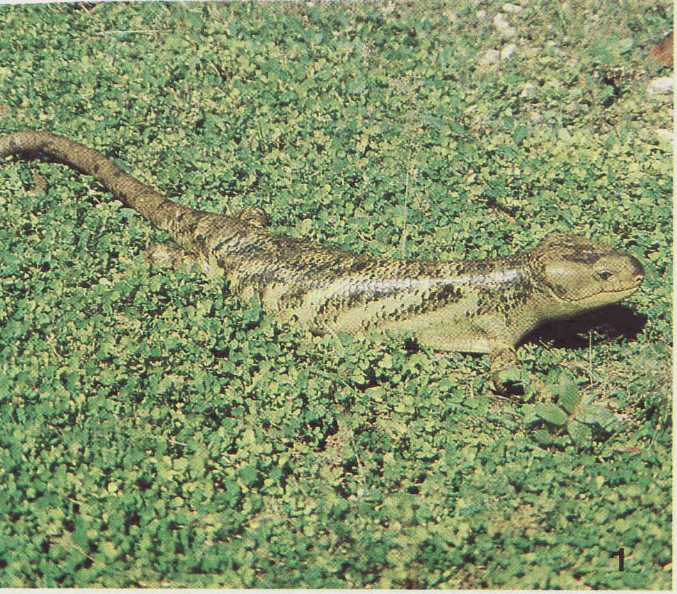
The total number of butterflies known to have been exported from Solomon Islands was 5 669 and 5 032 during 1989 and 1990 respectively (Table 3). Exporters are concentrating on birdwing butterflies, particularly *O. victoriae victoriae* (Queen Victoria birdwing) and *O. priamus urvillanus* (D'Urvilles birdwing). However, during 1990 there was a large rise in the number of non-papilionidae butterflies exported. Birdwing butterflies are generally exported in pairs, i.e., one male and one female. The sex ratio is roughly 1:1, although 74 males were sent singularly in 1989. Males of these species are more spectacularly coloured than females. The following countries were the destination for birdwing butterflies in 1989: USA = 48%; PNG = 30%; Japan = 19%; Philippines = 2%; and France = 1%; and in 1990 the destinations were: Japan = 43%; UK = 23%; USA = 16%; France =13%; Australia 4% and Malaysia = 1%.

Table 4 shows the number of insects other than butterflies exported from the Solomons. These receive much lower prices than butterflies so despite large numbers being exported, the relative value is only a minor component of the total trade. Of these, beetles (Coleoptera) was the main order exported, particularly longhorn beetles (Cerambicidae). The USA imported the largest number of insects (non-butterfly) during 1989 and 1990. They were also exported to PNG, Japan, France, Malaysia, Philippines and the UK.

DISCUSSION

The wildlife trade is utilising a diverse range of fauna. None of the reptiles or amphibians are captive bred and no farming or ranching of butterflies or other insects occurs. This is of concern as little is known about the status of many of these species.

One of the most common justifications for the wildlife trade in Solomon Islands has been its ability to generate cash income for village dwellers who have no capital resources. The sale of one *Varanus indicus* ($7 to $10 SI or $3.50 to $5 Aust.), by a village collector to an exporter is equivalent to a days wages for an average labourer. Only 15% of Solomon Islanders are in formal employment, and the remainder live in rural areas and have a subsistence life style with little or no cash income.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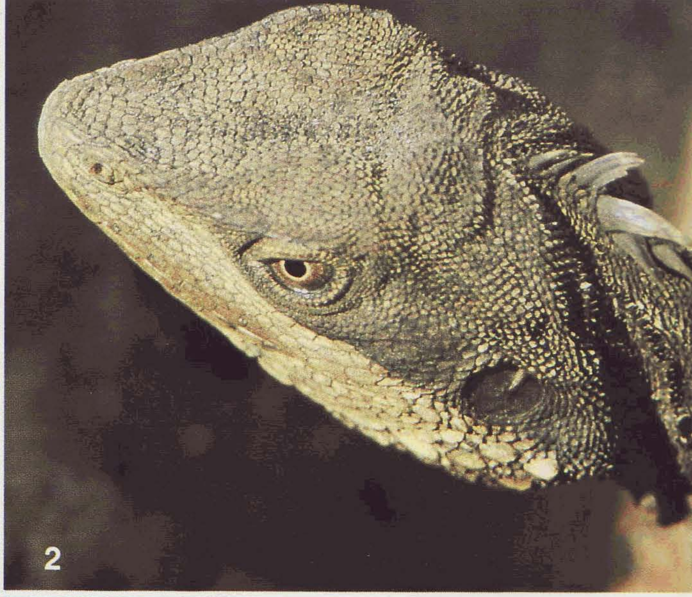
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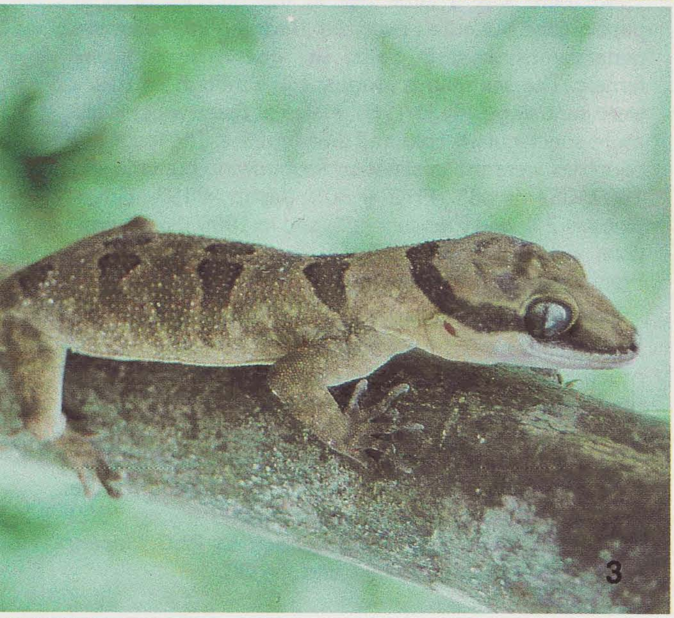
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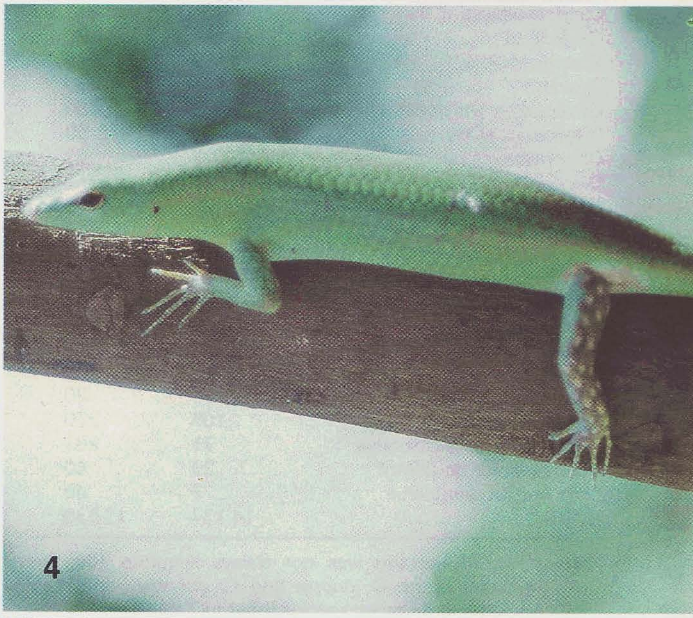
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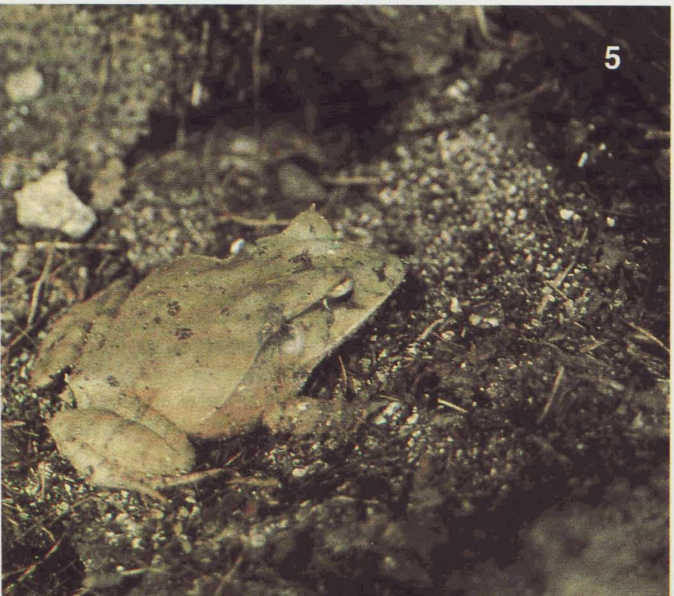
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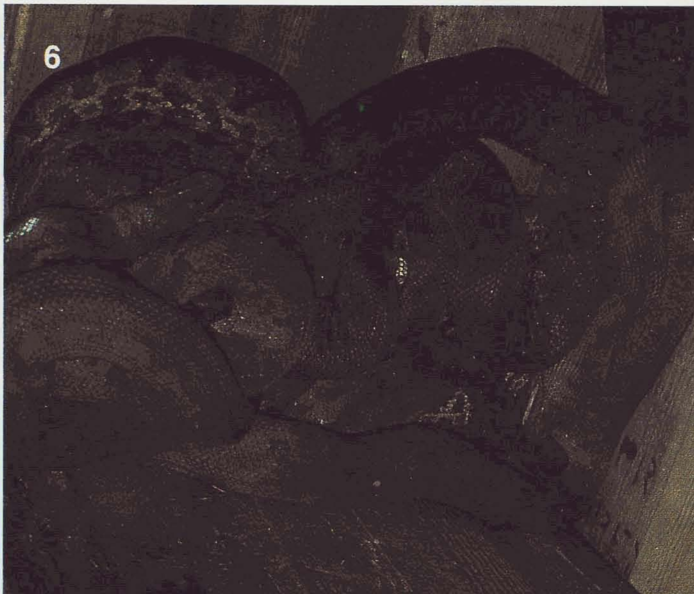
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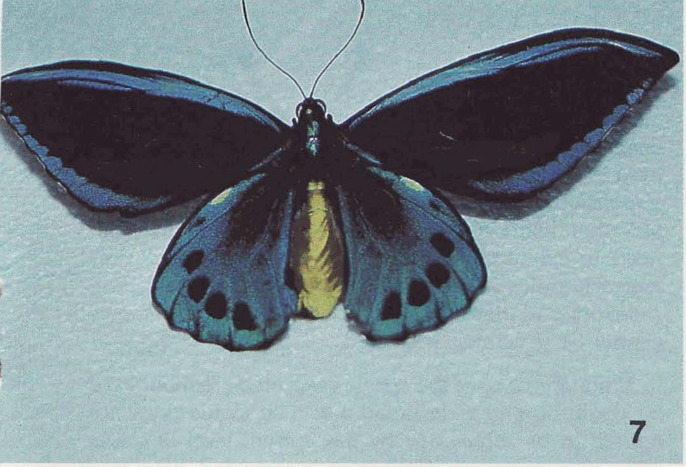
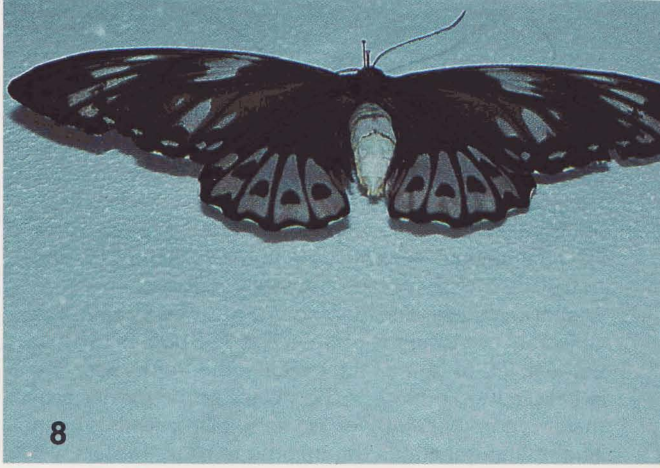
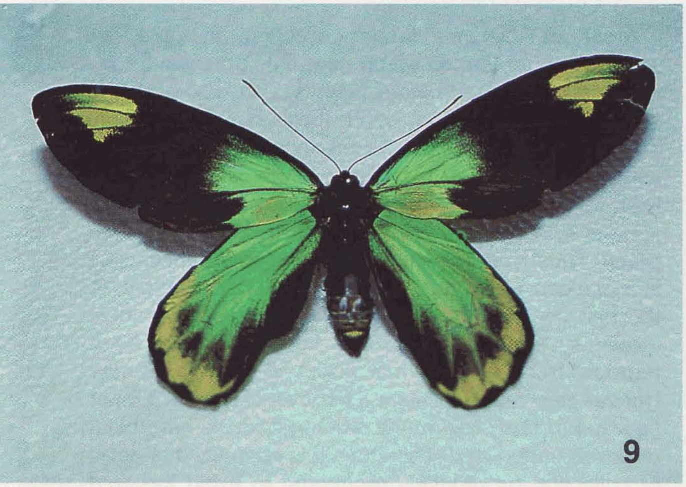


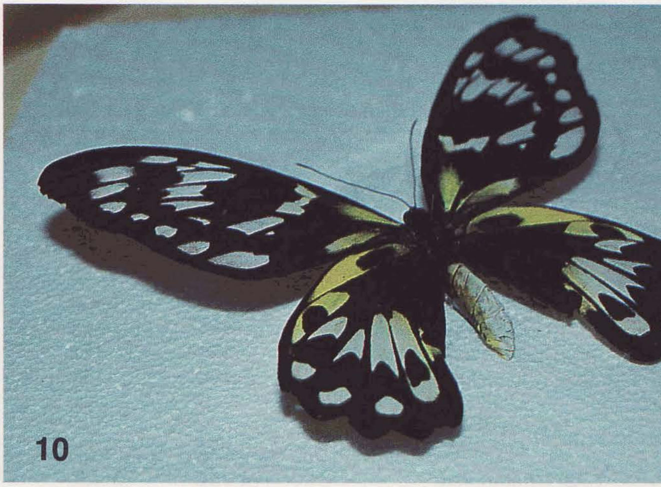
7: *Ornithoptera priamus urvillanus,* a male D'Urville's birdwing butterfly. A good quality specimen of this butterfly can earn a village collector the equivalent of one half to two thirds of a labourer's daily wage.



8: Female *O. priamus urvillanus*. 996 and 382 females were exported during 1989 and 1990 respectively.



9: *Ornithoptera victoriae* males are more brightly coloured than females, but they are generally exported in pairs.



10: *Ornithoptera victoriae* female. 2 764 and 1 715 individuals were exported during 1989 and 1990 respectively, of which approximately half were females.

1: *Corucia zebrata* (prehensile-tailed skink), commonly known as "Unu" in Solomon pidgin, is the main trade species and is endemic to Solomon Islands.

2: *Gonocephalus godeffroyi* (angle headed dragon) one of the species of restricted distribution which is exported.

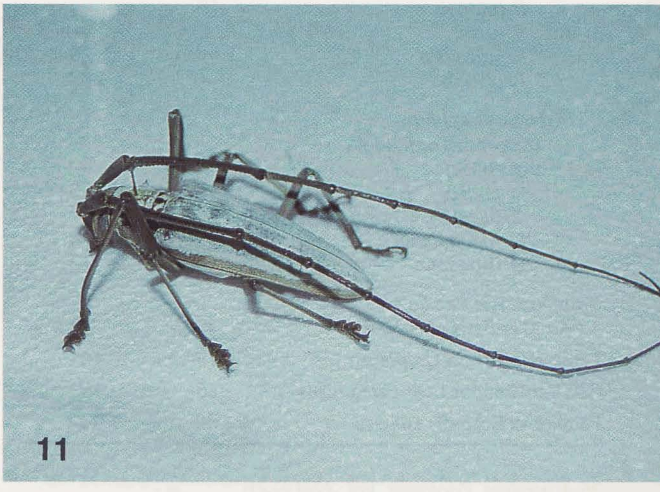
3: *Cyrtodactylus louisiadensis* (striped gekko) is commonly listed under the category gekkos of Family Gekkonidae.

4: *Lamprolepis smaradgina* is one of the species of Scincidae exported.

5: *Ceratobatrachus guentheri* (horned frog) is the most commonly exported frog species. This species is endemic to the Solomon Islands geographic region.

6: *Candoia carinata* (pacific ground boa) was the second and third most commonly exported species during 1989 and 1990 respectively. Known in Solomon pidgin as "sleeping snake", this species shows much colour variation as is apparent from the four individuals.

Photos: Tanya Leary.



11: Longhorn beetles (Family Cerambicidae) was the beetle family most commonly exported from the Solomons.

The wildlife trade is contributing to Solomon Islands foreign exchange earnings. However, the equity of distribution of income from wildlife trade is questionable. No formal records of income received from trade is kept, but from prices given by two exporters in 1989, estimates for total annual income vary between \$288 315 and \$1 200 322 (\$SI) or approximately half that much in Australian dollars. The total income received by all village collectors combined is estimated at \$88 906 in 1989 or between 7% to 30% of the total income from trade, and is believed to lie more in the vicinity of the former estimate. The primary justification for wildlife trade has been its ability to generate cash income to rural dwellers, yet it is the Honiara based exporters who receive the largest share of income. One exporter received 76% of the total income from wildlife trade, during 1989. Only a few Solomon Islanders are reaping the greatest benefit from the wildlife trade.

Table 3. Number of butterflies exported from Solomon Islands.

	Jan.–Dec. 1989	Jan.–Dec. 1990
Family: **PAPILIONIDAE**		
Genus: ***Ornithoptera***		
(Birdwing butterflies)		
O. victoriae victoriae	1 590	1 566
O. victoriae regina	484	119
O. victoriae epiphanus	530	161
O. victoriae rubianus	160	149
O. victoriae subsp. not specified	—	120
O. priamus urvillanus	1 992	764
Total *Ornithoptera*	**4 756**	**2 469**
Genus: ***Papilio***		
(Swallow-tail butterflies)		
P. polydorus	100	—
P. fuscus	70	10
P. bridgei	15	—
P. ulyses	2	—
P. ptolychus	—	26
Papilio sp.	—	283
Genus: ***Graphium***		
(Sword-tail or triangle butterflies)		
G. codrus	55	50
G. hileaton	20	—
G. macfarlanei	—	8
G. mendana	—	12
Graphium and *Papilio* (Mixed and not classified)	15	12
Total: *Papilio* and *Graphium*	**277**	**401**
Non Papilionidae butterfly families	636	2 162
Total of all Butterfly species	**5 669**	**5 032**

Knowledge of Solomon Islands fauna is largely confined to taxonomic and distributional information, and even this is incomplete. Much is still unknown regarding population dynamics, ecological requirements, and conservation status of these animals and exports therefore need to be carefully regulated. Without detailed ecological knowledge of species and without comprehensive monitoring of trade the effects of trade on many species cannot be accurately predicted.

Although many of the species exported are thought to be common and widespread and their status does not appear to be threatened by the current level of trade, other species whose distribution is restricted, have rare status, a low reproductive rate or whose habitat is limited or threatened by development are of concern. For these reasons a schedule of species permissible for export with quotas where applicable has been drafted (Leary 1990a).

Areas of intensive fauna collection, in particular small off-shore islands which have little potential for recolonization through natural dispersal, are also at risk of serious depletion of populations through over-collection. There are a number of bird endemics, particularly at the sub-species level, restricted to a single island and it is likely that in more poorly studied groups of animals, sub-species endemics may also be restricted to a single island. Thus, over collection on a small island may result in extinction of a unique sub-species. For example, in the first six months of 1989, 117 Spotted mangrove monitors *Varanus indicus* are known to have been removed from Savo, a small (about 30 km^2) island near Honiara (the capital). This is a removal of around 3.9 per sq km. It is likely that many other individuals have been removed undetected. Therefore, it is essential that areas of collection be regularly monitored to avoid localized extinctions of species or of sub-species or races restricted to a single island. A programme to monitor such areas has been drawn up (Leary 1990a).

If the trade is to continue, which is largely a political question, it is essential that the Solomon Islands Government manage it in a responsible manner. Continued uncontrolled exploitation of Solomon Islands fauna is likely to result in local extinctions of species in heavily collected areas, and poses a threat to rare or restricted species. It is therefore urgent that the Solomon Islands Government implement wildlife management recommendations outlined in Leary 1990a, which includes the drafting of legislation, regulations, and instituting careful monitoring of trade.

The wildlife trade review (Leary 1990a) provides guidelines for legislation and management of the wildlife trade. The government adopted this report in March 1991 and will implement the recommendations in the near future. Legislation will include: conditions for con-

Table 4. Total insect exports from Solomon Islands excluding butterflies.

	Jan.–Dec. 1989	Jan.–Dec. 1990
ORDER: **COLEOPTERA** (Beetles, family unspecified)	623	430
Family: **Cerambicidae** (Longhorn beetles)	718	1 293
" : **Lucaniidae** (Stag beetles)	390	521
" : **Cetoniinae** (Rosechaffers)	192	273
" : **Buprestidae** (Jewel beetles)	365	188
" : **Curculionidae** (Weevils)	175	136
Total No. of Beetles	**2 463**	**2 841**
ORDER: **ORTHOPTERA**		
Family: **Phasmidae** (Stick insects)	24	165
" : **Tettigonidae** (Grasshoppers)	83	11
ORDER: **HOMOPTERA** (Cicadas)	52	48

finement and shipping of fauna; licensing of exporters; requirements for record keeping by exporters so that geographic areas of collection may be monitored; and a schedule of species permissible for export with quotas which may be adjusted as further information on population status and ecology of species comes to light.

Trade does not appear to be the most widespread threat to Solomon Island fauna. As elsewhere in the world, habitat destruction continues to pose a threat. Solomon Islands has one of the highest population growths in the world (3.5%), this is leading to competing pressures on a limited land area. Lowland rainforests below 400 m are under the most pressure from the increasing area needed for food production in subsistence gardens (typically slash-burn agriculture), from large scale agricultural projects (copra and cocoa plantations), and from commercial logging. The fact that many species are restricted to one or two islands and that little is known of the habitat requirements of most species, coupled with an increasing human population can only emphasize the urgent need for more ecological work on Solomon Islands' unique fauna, if loss of species, primarily from habitat destruction, is to be avoided. For some species it may already be too late, with at least four species of mammal (Flannery, pers. comm.) and 10 species of bird not definitely recorded in the last 50 years (Diamond 1987).

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